Remarks

Applicants respectfully request that the Examiner reconsider the present application in light of the above amendments and following remarks. Claims 1 and 6-8 have been amended and claims 13-16 have been added. Therefore, claims 1-16 are pending in the present application.

Claims 1-12 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,779,220 to Nehl et al. ("the Nehl reference"). Applicants respectfully traverse this rejection.

Amended claim 1 is directed to a solenoid for providing linear actuation having first and second polepieces with axial bores that are coaxially disposed along a common axis, an electrical conductor wound about the polepieces in a plurality of turns, and an armature slidably disposed in the axial bores. In addition, a bearing is axially retained in one of said first and second polepieces and it operates to radially support a shaft. The shaft is attached coaxially to the armature and extends through a supportive bore in the bearing. The shaft is axially displaceable by electromagnetic displacement of the armature to provide the actuation.

By providing a solenoid in accordance with the present invention, numerous advantages are realized. For instance, the retention of the bearing in one of the polepieces provides radial support for the shaft when moving in an axial direction so that the sleeve used in the prior art is no longer necessary. *See Specification*, pg. 5, lines 1-7. Removing the sleeve used in prior art solenoid actuators allows for the air

gap between the actuator and the first polepiece to be narrowed, which results in improved performance of the solenoid in the present invention. *See* FIG. 3. In addition, the fact that the bearing is retained within one of the polepieces in the present invention minimizes wobbling of the shaft and allows the solenoid to operate without regard to spatial orientation. *See pg.* 5, lines 13-15; pg. 6, line 1.

In rejecting claim 1, the Examiner stated that "it would have been obvious to one skilled in the art at the time of the invention was made to move the bearing up in the polepiece." *Office Action*, pg. 2. However, the Federal Circuit has stated that a prima facie case of obviousness is not met unless "the teachings from the prior art itself would appear to have suggested the claimed subject matter to a person of ordinary skill in the art." *In re Bell*, 26 U.S.P.Q.2d 1529, 1531 (Fed. Cir. 1993) (quoting *In re Rinehart*, 189 U.S.P.Q. 143, 147 (C.C.P.A. 1976)). It is Applicants' position that none of the references of record teach or suggest a solenoid including a bearing that is axially retained in one of first and second polepieces and one that radially supports the shaft as recited in amended claim 1.

In contrast, the Nehl reference is directed to a solenoid having a shaft (96) positioned within a bearing (98), wherein the outer surface of the bearing is spaced a distance away from the wall of the bearing housing (78). *See* Col. 3, lines 41-44; FIG. 2. Thus, the bearing is loosely positioned between the opposing walls of the bearing housing, not retained between one of the polepieces.

Not only does the Nehl reference fail to suggest a solenoid having an axially retained bearing that radially supports the shaft, it actually teaches away from retaining or holding the bearing between one of the polepieces. *See In re Gurley*, 27 F.3d 551, 554 (Fed. Cir. 1994). Specifically, the bearing in the Nehl reference is described as being free to float within the clearances to allow for radial movement of the shaft. *See* Col. 3, lines 44-48. The Nehl reference explicitly states that the bearing is "not in a fixed position." Col. 3, line 43. The fact that the bearing is permitted to float between the bearing housing allows the shaft to move radially, which in turn results in wobbling of the shaft. Thus, the Nehl reference actually highlights one of the problems that the present invention intends to solve. As such, the Nehl reference does not provide the necessary teachings or motivation to render the present invention obvious.

For at least the forgoing reasons, Applicants respectfully request that the rejection of claim 1 be withdrawn. As claims 2-5 depend from claim 1, these claims are also not taught or suggested by the references of record for the same reasons set forth with respect to claim 1. Thus, Applicants request that the rejection of claims 2-5 also be withdrawn.

Dependant claims 2-5 include additional features that are novel in view of the references of record. For instance, dependant claim 3 is directed to the solenoid recited in claim 1 with an armature that is frusto-conical. The frusto-conical shape of the armature is beneficial in that it "provide[s] the absolute minimum thickness of air

gap while positively precluding the armature from striking the polepieces." *Specification*, pg. 5, lines 18-20. While the Examiner has taken the position that the Nehl reference includes a frusto-conical armature, he has provided no support for such a finding. *See Ex parte Humpherys*, 24 USPQ.2d 1255 (B.P.A.I. 1992) (stating that the Examiner must provide specific reasons to support an obviousness rejection). The Nehl reference states that the radial air gap between the outer cylindrical wall (164) of the armature (146) and the inner cylindrical wall (162) of the cylindrical center pole (120) is "fixed" and "will not vary due to a changing gap dimension." Col. 4, lines 57-65. There is no indication that the air gap is slightly thinner at one end of the armature and slightly thicker at the opposite end of the armature as provided with a frusto-conical armature in the present invention. *See Specification*, pg. 5, lines 20-21.

As with claim 1, claims 6, 7 and 8 are directed to a solenoid including a bearing that is axially retained in one of first and second polepieces and one that radially supports the shaft. Therefore, Applicants submit that claims 6, 7 and 8 are also not taught or suggested by the Nehl reference for at least the same reasons set forth with respect to claim 1. Since claims 9-12 depend from claim 8, these claims are also allowable over the Nehl reference for at least the same reasons discussed above with respect to claim 1. Moreover, claim 10 is believed to be novel since there is no teaching or suggestion of a frusto-conical armature in the references of record.

Newly added claims 13-16 are also patentable in view of the references of record. In particular, claims 13-16 are directed to a solenoid having a bearing with an axial length that is 1.5 times larger than the diameter of the shaft. None of the references of record teach or suggest this particular feature. Thus, Applicants submit claims 13-16 are allowable and such allowance is respectfully requested.

Conclusion

Accordingly, Applicants submit that claims 1-16 are in condition for allowance and such allowance is respectfully requested. Should the Examiner feel that any unresolved issues remain in this case, the undersigned may be contacted at the telephone number listed below to arrange for an issue resolving conference.

Applicants do not believe that any fees are due at this time, however, in the event that any fees have been overlooked, the Commissioner is hereby authorized to charge any fees that may be due to Deposit Account No. 10-0223.

Respectfully submitted,

10-14-03
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